

EMFAC2002 Training Examples

Hint :— Throughout these examples text that is “**bolded**” indicates action items. The user should press dialog labeled in bold lettering. Further, “*italicized*” text shows the label next to the dialog boxes.

Burden

1. This example forecasts an emissions inventory showing the tons of pollutants emitted daily during the summer of 2010 in the South Coast Air Basin (SCAB). The example is designed to show several different output files that are used mainly for planning purposes. The user should follow these steps:
 - 1) **Run** EMFAC2002.
 - 2) Select “**File**” and click “**New.**”
 - 3) Click “**Add New Scenario.**”
 - 4) Click “**Geographic Area**”, and under *area type* select “**Air Basin.**” Then from the drop down list under air basins select “**South Coast.**” Finally set the method selection to “**Simple Average.**” Click “**OK.**”
 - 5) In the box next to *Calendar Year* type in “**2010.**”
 - 6) From the drop down list for *Season or Month* select “**Summer.**” Then click “**Next**” to proceed to the screen titled *Scenario2*.
 - 7) In this run there are no changes in *Scenario2*. Click “**Next**” and proceed to the *Mode and Output* screen.
 - 8) In the *Mode and Output* screen Select the *Scenario Type* as “**Burden – Area Planning Inventory (tons per day).**” Under *Select Output Files and Options* choose “**Planning Inventory, Text File (CSV), MVEI7G CSV File, and Weight Output.**”
 - 9) Under *Output Frequency* select “**Daily Totals Only.**”
 - 10) Under *Output Particulate* as select “**PM10**” and under *Output Hydrocarbons* as select “**ROG.**” Click “**Finish.**” The user should now be at the *MAIN* screen.
 - 11) Click “**Save As**” to save and name the input file to an appropriate folder (folder Ex1 in the examples.zip file). In this example, the input file was named “**SCAB_ave_2010_Burden.**” This follows a simple naming convention which corresponds to an area selection for the **S**outh **C**oast **A**ir **B**asin, method selection of simple **ave**rage, calendar year of **2010**, and the output mode selection of **Burden**. Note the output files will have the same name as the input file but with different extensions.
 - 12) Click “**Run**” to start the model.

The following output files are generated:

- SCAB_ave_2010_Burden.BUR – Planning Inventory. This is an older formatted file, which has been retained from previous versions of EMFAC¹. This file should be opened using MS-Word then formatted following these steps. In MS-Word under the “**Edit**” menu click “**select all**.” Then under “**Format**” select “**Font**” and change the font to “**courier new 6**.” Then select “**File**” and under “**Page Setup**” set the *pagesize* to “**landscape**” and then change the left and right margin size to 3. The user may have to adjust the top and bottom margins to print on one page. Note this is an older format that has been maintained for continuity.
 - SCAB_ave_2010_Burden.CSV – Text File. This is the preferred output because it provides more detail, which can easily be opened using MS-Excel.
 - SCAB_ave_2010_Burden.BCD – MVEI7G. This has a columnar output, which is used in databases. This file can also be opened using MS-Excel. Open this file using MS-Excel. **Highlight** column A and then select “**Data**,” and then convert the comma delimited data using the **text to columns** conversion.
 - SCAB_ave_2010_Burden.WT – This file can be viewed using any text editor. This file shows vehicle population, Vehicle Miles Traveled (VMT) per day, trips per day, accrual per year, and odometer by model year, technology class (non-cat, cat and diesel), and vehicle class.
2. This example shows what is in the “Heavy-Duty Truck Detail” output file. Again, this is an older formatted file that has been retained from MVEI7G. The file was originally created to provide more detailed inventories from all trucks, and also allow the user to print this information on one page. This example is the same as (Ex1) except the output selection is different. The user should follow these steps:
- 1) **Run** EMFAC2002.
 - 2) Follow steps 2 to 7 as shown in example Ex1.
 - 3) In the Mode and Output screen select the *Scenario Type* as “**Burden – Area Planning Inventory (tons per day)**.” Under *Select Output Files and Options* choose “**Heavy-Duty Detail**.”
 - 4) Follow steps 9 to 10 as shown in example Ex1.
 - 5) Click “**Save As**” to save and name the input file to an appropriate folder (folder Ex2 in the examples.zip file). In this example, the input file was named “**SCAB_ave_2010_extend_Burden**.”
 - 6) Click “**Run**” to start the model.

The following output file is generated:

¹ This file format was available in EMFAC7E/7F and MVEI7G.

- SCAB_ave_2010_extend_Burden.BUR – This file should be opened using MS-Word and formatted following these steps. In MS-Word under the **Edit** menu click **select all.** Then under **Format** select **Font** and change the font to **courier new 5.** Then select **File** and under **Page Setup** set the *pagesize* to **landscape** and then change the left and right margin size to 2. The paper_size selection should be set to **Legal.** The user may have to adjust the top and bottom margins to print on one page. This formatting and paper size selection ensures that the output will fit on one legal size page.
3. This example shows what information is generated when the method selection is set to “Do Each Sub-Area.” In example 1 and 2, the method selection was set to “Simple Average.” The difference between the two methods has to do with accuracy and speed. In an earlier version of EMFAC² it took over an hour to calculate an emissions inventory for one area. A detailed statewide run would take over 24 hours. Staff decided to minimize the calculation time by area-averaging parameters like temperature, relative humidity, speed, and setting the IM options to those from the most populous area in the entire region. This area-averaging method is represented by the “Simple Average” option. In the “Do Each Sub-Area” option the model calculates an inventory for each area within the air basin or air pollution control district. This is the most accurate inventory and should be used for official planning purposes. The user should follow these steps:
- 1) **Run** EMFAC2002
 - 2) Select **File** and click **New.**
 - 3) Click **Add New Scenario.**
 - 4) Click **Geographic Area,** and under *area type* select **Air Basin.** Then from the drop down list under air basins select **South Coast.** Finally set the method selection to **Do Each Sub-Area.** Click **OK.**
 - 5) Follow steps 5 to 10 as shown in example Ex1. However, only select **Text File (CSV)** to output.
 - 6) Click **Save As** to save and name the input file to an appropriate folder (folder Ex3 in the examples.zip file). In this example, the input file was named **SCAB_subarea_2010_Burden.**
 - 7) Click **Run** to start the model.

The following output file is generated:

- SCAB_subarea_2010_Burden.CSV – Text File. This output contains emission inventories by sub-area, and also provides a total inventory for the entire area. Note the sub-area run is more accurate than the

² EMFAC2000

simple average run because model calculates emissions using area specific data.

4. In this example the model is run hourly to provide emission inventories by hour. This output is useful to ambient air quality modelers who are interested in hourly emission inventories. Again the area selection is SCAB, the method selection is simple average to minimize the size of the output file, and the calendar year is 2010. The user should follow these steps:
 - 1) **Run** EMFAC2002
 - 2) Follow steps 2 to 8 as shown in example Ex1. However, only select **“Text File (CSV)”** to output.
 - 3) Under *Output Frequency* select **“Results For Each Hour.”**
 - 4) Follow step 10 as shown in example Ex1.
 - 5) Click **“Save As”** to save and name the input file to an appropriate folder (folder Ex4 in the examples.zip file). In this example, the input file was named **“SCAB_ave_byhour_2010_Burden.”**
 - 6) Click **“Run”** to start the model.

The following output file is generated:

- SCAB_ave_byhour_2010_Burden.CSV – Text File. In this run the Burden inventories are calculated on an hourly basis, and then aggregated to show an inventory for the entire day. The hourly inventories are mainly based on dis-aggregating daily activity to an hourly basis using instrumented vehicle activity data. This data provides diurnal distribution of hourly trip starts, vehicle miles traveled, a distribution of vehicles operating / resting in each hour.
5. Up to now all the examples involve calculating an inventory for one geographic area or one scenario. This example shows how the user can calculate inventories for two different areas in one run. The purpose of this example is to show that the model can calculate inventories for multiple areas provided only the basic scenario data are changed. In this perspective, the model can be considered as a multiple scenario model.
 - 1) **Run** EMFAC2002
 - 2) Follow steps 2 to 10 as shown in example Ex1. However, only select **“Text File (CSV)”** to output. Note the main screen will list the first scenario (for SCAB). The user will now add another scenario following the steps listed below.
 - 3) At the main screen, select **“Add New Scenario.”**

- 4) Click "**Geographic Area**", and under *area type* select "**State**." Then set the method selection to "**Simple Average**." Click "**OK**." Then follow steps 5 to 10 as shown in example Ex1.
- 5) Click "**Save As**" to save and name the input file to an appropriate folder (folder Ex5 in the examples.zip file). In this example, the input file was named "**Multi_Area_2010_Burden**." Note there should be two scenarios listed under the *List of Available Scenarios* section.
- 6) Click "**Run**" to start the model.

The following output file is generated:

- Multi_Area_2010_Burden.CSV – Text File. The file shows simple average inventories for SCAB and the State in 2010 calendar year. Note the outputs for each area is appended. Users should be cautioned that this could result in large output files in other modes.

Emfac

6. In the Emfac mode the model calculates emission factors either in grams per hour or grams per mile for each temperature, relative humidity and speed combination specified by the user. This example is designed around a hypothetical question asking "how will the emissions vary with speed at a temperature of 75°F and at 40% relative humidity for vehicles in the SCAB in calendar year 2010?"
 - 1) **Run EMFAC2002**
 - 2) Follow steps 2 to 7 as shown in example Ex1.
 - 3) In the *Mode and Output* screen *Select the Scenario Type* as "**Emfac – Area Fleet Average Emissions (g/hr)**." Under *Select Output Files and Options* choose "**Binary Impacts, ASCII Impacts, Rate Summary, and Impact Rate Detail**."
 - 4) Under *Output Particulate* as select "**PM10**" and under *Output Hydrocarbons* as select "**ROG**." Click "**Next**." The user should now be at the *Emfac Config* screen.
 - 5) Click the "**Temperature**" box to *Select/Edit Temperatures For Emfac calculations*. **Move** the cursor to *Delete Temperature 1*, and click on "**Delete**." This will delete the first temperature. Repeat this process until *Delete Temperature 1* is 75. Then move the cursor over *Delete Temperature 2* and **delete** subsequent temperatures. Click "**OK**." This will take you back to the *Emfac Config* screen.
 - 6) Click the "**Relative Humidity**" box to *Select/Edit the Humidity Intervals*. Repeat steps noted in 6) above such that the relative humidity is set to 40%. Click "**OK**" to get back to the *Emfac Config* screen.
 - 7) Click the "**Speed**" box to *Select/Edit the Speed Intervals*. This dialog screen shows that the Emfac mode is configured to output emission

rates for all average trip speeds from 5 mph to 65 mph. In this example, the user is also interested in calculating idle emissions at 0 mph. To do this, **move** the cursor to the circle next to *Enter Speed 14* and click on the circle. This will activate the box. **Click** inside the box and then enter a zero “0.” Click “OK.” Then click “Finish” at the *Emfac Config* screen.

- 8) The user should now be at the *MAIN* screen.
- 9) Click “**Save As**” to save and name the input file to an appropriate folder (folder Ex6 in the examples.zip file). In this example, the input file was named “**SCAB_ave_2010_Emfac.**”
- 10) Click “**Run**” to start the model.

The following output files are generated:

- SCAB_ave_2010_Emfac.BIN – Binary Impacts. This is a binary file, which cannot be read by normal text editors. This file has the same information as the ASCII Impacts file but is in binary format. This format was used in an older Direct Travel Impacts Model (DTIM) version (DTIM3).
- SCAB_ave_2010_Emfac.ERP – ASCII Impacts. This output is now used as an input to DTIM4. Tables 1 and 2 in Appendix 1 detail the format of the ASCII Impacts file and report on the units for each emissions process. The DTIM model is used in calculating spatially allocate emission inventories. In this respect, the ASCII Impacts file serves as a giant lookup table because it can contain emission rates for all temperature, relative humidity and speed combinations. If Emfac is run in default mode (for all temperatures, relative humidities and speeds) the output file is 18 MB in size. DTIM users should selectively output emission factors for certain temperature, relative humidity and speed combinations to minimize the size of the output file such that it conforms to the array size limitations in DTIM4.
- SCAB_ave_2010_Emfac.RTS – Rate Summary. This file is best viewed using MS-Wordpad or notepad. This file contains emission rates (again by temperature, relative humidity and speed) for various vehicle class groups. For example, the heavy-duty group contains weighted emission rates from medium-heavy, heavy-heavy duty trucks and motor homes.
- SCAB_ave_2010_Emfac.RTL – Impact Rate Detail. This is a comma-separated file that can be opened using MS-Excel. This is the preferred output in Emfac mode because it contains detailed emission factors by vehicle class. This file format is also used as an input to the land-use planning model, URBEMIS³.

³ URBEMIS, which stands for “Urban Emissions Model,” is used to estimate emissions associated with land development projects in California such as residential neighborhoods, shopping centers, and office buildings; area sources such as gas appliances, woodstoves, fireplaces, and landscape maintenance equipment; and construction projects.

Calimfac

7. In the Calimfac mode the model calculates zero mile emission rates and deterioration rates, by model year. These rates are calculated for with IM and without IM programs. A brief history will put this mode in context with the other output files. Previously, Calimfac was a separate program. The output from this program was used in calculating the benefits from the smog check program. Further, the output was used as an input to the EMFAC 7F/G models. The outputs shown in this example are rarely used now because the Burden and Emfac modes use emission rates precisely calculated for a specific age or mileage, whereas, the regressions in the *.OUT file are based on a linear fit of the non-linear emission rates. This example outputs “FTP” based emission rates following steps outlined below.

- 1) **Run** EMFAC2002.
- 2) Follow steps 2 to 7 as shown in example Ex1.
- 3) In the *Mode and Output* screen *Select the Scenario Type* as “**Calimfac – Detailed vehicle data (g/mi)**.” Under *Select Output Files and Options* choose “**Emission Factors without IM, Emission Factors with IM, IM Credits, Technology Group Detail, Regime Growth Rates and Model Year Em. Rates.**”
- 4) Under *Output Particulate* as select “**PM10**” and under *Output Hydrocarbons* as select “**ROG.**” Click “**Next.**” The user should now be at the *Calimfac Config* screen.
- 5) Under *CALIMFAC bag options* select “**FTP Composite (g/mi)**”. Under *CALIMFAC Correction Factors* select “**Full Correction Factors.**” Then click “**Finish**” at the *Calimfac Config* screen.
- 6) The user should now be at the *MAIN* screen.
- 7) Click “**Save As**” to save and name the input file to an appropriate folder (folder Ex7 in the examples.zip file). In this example, the input file was named “**SCAB_ave_2010_FTP_WC_Calimfac.**”
- 8) Click “**Run**” to start the model.

The following output files are generated:

- SCAB_ave_2010_FTP_WC_Calimfac.OUT– Emission Factors. Contains a zero mile emission rate, deterioration rate as a function of vehicle mileage (per 10000 miles), and a flex-pt (the point where the deterioration rate changes). In this mode, the emission rates for all the emission processes are a function of vehicle mileage. Note, the model year emission rates are calculated up to the scenario year. Hence the emission rate for a 2007 model year vehicle in 2010 calendar year is only based on a linear regression fit on three data points.
- SCAB_ave_2010_FTP_WC_Calimfac.CYW – Emission Factors. This file contains calendar year weighted emission factors beginning with

1980 to the scenario year. Table 3 in Appendix 1 details the units for emission factors displayed in the *.CWY file.

- SCAB_ave_2010_FTP_WC_Calimfac.RG1 to RG6 – Regime Growth rates. These files show the percent of vehicles in each emission regime, by vehicle class, model year, tech group, age and pollutant.
- SCAB_ave_2010_FTP_WC_Calimfac.MY1 and MY2 – Model Year Emission Rates. These files show the model year emission rates from age 1 to the age corresponding to the scenario year. The units are shown in Table 4 in Appendix 1.

Inspection And Maintenance

8. In this example, it is assumed that the San Francisco Bay Area (noted as SFAB) adopts an ASM program for light-duty vehicles beginning in 2004. The planner is asked to calculate “what emission reductions are associated with adopting this new inspection program by calendar year 2010?” Listed below is a brief outline of this example, which is then followed by detailed steps.

- Multiple scenario run.
 - Base run with SFAB for summer 2010. Then add another scenario.
 - Second scenario, add another program beginning January 2004. Then set the IM options to: test type = ASM, interim cutpoints, vehicle class PC-MDV.
- 1) Follow steps 1 to 10 as shown in example Ex1 with the following exceptions. In the “**Geographic Area**” and under “**Air Basin**” select San Francisco Air Basin. The method selection should be set to “**Simple Average**.” Further, only output the **Text File (CSV)** format.
 - 2) At the main screen, select “**Add New Scenario**.”
 - 3) At the *Scenario1* screen click “**Next**”
 - 4) In *Scenario2* screen change the title to reflect that ASM testing will be done on vehicles. In this example the title is “**San Francisco Air Basin Avg 2010 Summer ASM PC-MDV**.”
 - 5) In *Scenario2* screen click on “**I/M Options**.”
 - 6) Under the *Program* heading click on “**Add**.” A dialog box titled “*I/M Program Start Date*” should pop up. In the box labeled *Enter Start Year* type in “**2004**.” In the box labeled *Enter Start Month* select the month as “**January**.” Leave the number of sub-programs to 1. Click “**OK**.” In these steps, the user has just added a new inspection program, with one sub-program, beginning in 2004.
 - 7) The *I / M Programs* dialog box will now show that the user specified program is now active. In this case “*Program 5 and Subprogram 1 are currently active*.” Click on the “**Edit Active Data**” box. A dialog box labeled *Program 5 subprogram 1* will pop up.

- 8) In the box labeled *Vehicles Included*, check on **Light-Duty Autos, Light-Duty Trucks, Medium-Duty Vehicles** and uncheck **Heavy-Duty-gas**.
 - 9) In the box labeled *Exhaust Test Type*, check on **"ASM."** Click **"OK"** and the user should be back at the *I / M Programs* dialog box. Click **"Finished Editing IM."** The user should be back to *Scenario2* screen.
 - 10) Click **"Next"** to proceed to the *Mode and Output* screen. At this screen click **"Finish,"** to get back to the *MAIN* screen.
 - 11) Click **"Save As"** to save and name the input file to an appropriate folder (folder Ex8 in the examples.zip file). In this example, the input file was named **"SFAB_Enhanced_ASM_2010."**
 - 12) The user should now **run** the model, and examine the difference in emissions between the default and modified runs.
9. Vehicles older than 35 years or pre-1974 model year are exempt from the current smog check program. In this example it is assumed that this exemption is removed for **all** vehicles subject to smog check program beginning 2005. The planner is asked to calculate "what are the emission reductions associated with eliminating this vehicle exemption by calendar year 2010?" Listed below is a brief outline of this example, which is then followed by detailed steps.
- Multiple scenario run.
 - Base run with SCAB for summer 2010. Then add another scenario.
 - Second scenario, add another program, with two sub-programs, beginning January 2005. Then set the maximum vehicle age to 45 and the first model year to 1965. These are found under the heading "vehicle inspection."
- 1) Follow steps 1 to 10 as shown in example Ex1 except only output the **Text File (CSV)** format. This will create the base scenario.
 - 2) At the *MAIN* screen, select **"Add New Scenario."**
 - 3) At the *Scenario 1* screen click **"Next."**
 - 4) In *Scenario 2* screen change the title to reflect vehicle exemption. In this example the title is **"South Coast Air Basin Avg 2010 Summer eliminate veh exemption."**
 - 5) In *Scenario 2* screen click on **"I/M Options."**
 - 6) Under the *Program* heading click **"Add."** A dialog box titled "I/M Program Start Date" should pop up. In the box labeled *Enter Start Year* type in 2005. In the box labeled *Enter Start Month* select the month as **January**. Change the number of sub-programs to **2**. Click **"OK."** In these steps, the user has just added a new inspection program, with two sub-programs, beginning in 2005.
 - 7) The *I / M Programs* dialog box will now show that the "user" specified program is now active. In this case **"Program 6 and Subprogram 2 are**

- currently active.* Click on the **Edit Active Data** box. A dialog box labeled *Program 6 subprogram 2* will pop up.
- 8) In the box labeled *Vehicle Inspection* change *Maximum Vehicle Age* from "30" to **45.** Then change *First Model Year* from "1974" to **1965.** Click **OK.**
 - 9) Repeat processes noted in steps 7 and 8 for *Program 6 and Subprogram 1.*
 - 10) Click **Finished Editing IM.** The user should be back to the *Scenario 2* screen.
 - 11) Click **Next** to proceed to the *Mode and Output* screen. At this screen click **Finish,** to get back to the *MAIN* screen.
 - 12) Click **Save As** to save and name the input file to an appropriate folder (folder Ex9 in the examples.zip file). In this example, the input file was named **SCAB_Eliminate_Veh_Exemption_2010.**
 - 13) The user should now **run** the model, and examine the difference in emissions between the default and modified runs.
10. Passenger cars to medium-duty trucks in the SCAB region are currently subject to ASM testing. The number of vehicles failing the exhaust test is based on *Interim* ASM cutpoints. In this example, the planner is asked to calculate "what additional emission reductions can be gained from a new IM program, beginning 2005, that uses *SIP* cutpoints?" Please note these tighter cutpoints, labeled as *SIP* cutpoints, represent ASM cutpoints originally proposed in 1996. Listed below is a brief outline of this example, which is then followed by detailed steps.
- Multiple scenario run.
 - Base run with SCAB for summer 2010. Then add another scenario.
 - Second scenario, add another program, with one sub-program, beginning January 2005.
 - Edit the program labeled "user" "sub-program 1." Select vehicle classes PC to MDV, set exhaust test type to "ASM", and then set Exhaust Test Cutpoints to "ASM."
- 1) Follow steps 1 to 10 as shown in example Ex1 except only output the **Text File (CSV)** format. This will create the base scenario.
 - 2) At the *MAIN* screen, select **Add New Scenario.**
 - 3) At the *Scenario 1* screen click **Next.**
 - 4) In *Scenario 2* screen change the title to reflect vehicle exemption. In this example the title is **South Coast Air Basin Avg 2010 Summer SIP based cutpoints.**
 - 5) In *Scenario 2* screen click on **I/M Options.**
 - 6) Under the *Program* heading click on **Add.** A dialog box titled "I/M Program Start Date" should pop up. In the box labeled *Enter Start Year* type in **2005.** In the box labeled *Enter Start Month* select the

- month as **January.** The number of sub-programs should be kept at 1. Click **OK.** In these steps, the user has just added a new inspection program, with one sub-program, beginning in 2005.
- 7) The IM dialog box will now show that the user-specified program is now active. In this case *“Program 6 and Subprogram 1 are currently active.”* Click on the **Edit Active Data** box. A dialog box labeled *Program 6 subprogram 1* will pop up.
 - 8) In the box labeled *Vehicles Included* select **Light-Duty Autos, Light-Duty Trucks, Medium-Duty Trucks,** and deselect **Heavy-Duty Gas.** Then in a box labeled *Exhaust Test Type* select **ASM.** Finally, in the box labeled *Exhaust Test Cutpoints* select **SIP Cutpoints.** Click **OK.**
 - 9) Click **Finished Editing IM.** The user should be back to the *Scenario 2* screen.
 - 10) Click **Next** to proceed to the *Mode and Output* screen. At this screen click **Finish,** to get back to the *MAIN* screen.
 - 11) Click **Save As** to save and name the input file to an appropriate folder (folder Ex10 in the examples.zip file). In this example, the input file was named **SCAB_SIP_Cutpoints_2010.**
 - 12) The user should now **run** the model and examine the difference in emissions between the two scenarios.
11. Users frequently ask the question “what would the emissions be if there were no smog check program?” This requires calculating emissions from a scenario “without I&M” programs. Listed below is a brief outline of this example, which is then followed by detailed steps.
- Multiple scenario run.
 - Base run with Sacramento Valley Air Basin (SVAB) for summer 2010. Then add another scenario.
 - Second scenario, edit IM options.
 - Keep deleting the IM programs.
- 1) Follow steps 1 to 10 as shown in example Ex1 with the following exceptions. In the **Geographic Area** and under **Air Basin** select **Sacramento Valley** Air Basin. The method selection should be set to **Simple Average.** Further, only output the **Text File (CSV)** format.
 - 2) At the main screen, select **Add New Scenario.**
 - 3) At the *Scenario 1* screen click **Next.**
 - 4) In *Scenario 2* screen change the title to reflect vehicle exemption. In this example the title is **Sacramento Valley Air Basin Avg 2010 Summer NOIM.**
 - 5) In *Scenario 2* screen click on **I/M Options.**

- 6) In the box labeled *Programs* click on the “**Delete Final.**” Repeat this process until all available IM programs are removed from the current scenario.
- 7) Click “**Finished Editing IM.**” The user should be back to *Scenario 2* screen.
- 8) Click “**Next**” to proceed to the *Mode and Output* screen. At this screen click “**Finish,**” to get back to the *MAIN* screen.
- 9) Click “**Save As**” to save and name the input file to an appropriate folder (folder Ex11 in the examples.zip file). In this example, the input file was named “**SVAB_NOIM_2010.**”
- 10) The user should now **run** the model and examine the difference in emissions between the two scenarios.

Changing VMT

12. CARB has published a guidance document titled “Recommended methods for using EMFAC2000 for emissions budgets and assessing conformity.” This document (available at <http://www.arb.ca.gov/msei/msei.htm>) outlines the preferred method for matching VMT. EMFAC users involved with planning are frequently asked to estimate emissions resulting from changes in VMT. The changes in VMT come from revised planning assumptions regarding growth in a particular region. In this hypothetical example, it is assumed that there is an increase in VMT, in the portions of Riverside and San Bernardino counties that reside in the SCAB. It is assumed that the VMT in Riverside and San Bernardino in 2006 calendar year will be 50 million miles per day and 40 million miles per day, respectively. The planner is asked, “how will this growth in VMT affect emissions?” Listed below is a brief outline of this example, which is then followed by detailed steps.

- **Note**, this is a single scenario model!
- Do a base SCAB sub-area run for 2006
- Do a new run for the same region but press “edit fundamental data.”
- Click next at the “Tech / IM ” dialog.
- Model, VMT calculated from the product of Population * Accrual. To match the VMT, the population had to be adjusted. First calculate by how much the population should be increased.
- The VMT in Riverside is 41,937,604 miles per day. The VMT in San Bernardino is 32,225,784 miles per day. The adjustment factor for Riverside is (50,000,000 / 41,937,604 = 1.192247416), and for San Bernardino it is (40,000,000 / 32,225,784 = 1.241242106).
- Click back and go back to the pop/accrual dialog box.
- Multiple the default population in Riverside (1,032,369) by 1.192247416 and in San Bernardino (934,733) by 1.241242106. The new populations should be 1230839 in Riverside, and 1160230 in San Bernardino.

- Then go to the “ VMT / Trips ” and verify the VMT changes.
 - EXAMINE the different outputs. Note, changes in VMT made by changing population also affect the number of trips.
- 1) Run EMFAC2002
 - 2) Follow steps 1 to 11 as shown in example Ex1 with the following changes. This base scenario should be run for 2006 calendar year. The method selection under **Geographic Area** should be set to “**Do Each Sub-Area.**” Finally in the *Modes and Output* screen only select the **Text File (CSV)** format to output. This base scenario, used for comparative purposes, is saved as “SCAB_Subarea_base_2006” in this example. Click “**Run**” to run this scenario.
 - 3) Run EMFAC2002
 - 4) Select “**File**” and click “**New.**”
 - 5) Click “**Add New Scenario.**”
 - 6) Click “**Geographic Area,**” and under *area type* select “**Air Basin.**” Then from the drop down list under air basins select “**South Coast.**” Finally set the method selection to “**Do Each Sub-Area.**” Click “**OK.**”
 - 7) Follow steps 5 to 10 as shown in example Ex1. However, the run should be for 2006 calendar year and only select “**Text File (CSV)**” to output.
 - 8) At the *Mode and Output* screen, click on “**Edit Program Constants.**” The user should now be at the *Tech I / M* screen. Click “**Next**” to proceed to the next screen.
 - 9) At the *Pop / Accrual* screen click on “**Population.**”
 - 10) A dialog box will pop up titled “Editing Population data for scenario 1: South Coast Air Basin Avg 2006 Summer Default Title.” This dialog box displays vehicle population by sub-area.
 - 11) Click on the tab labeled “**Riverside (SC)**” and record the total population. The total population is 1,032,369. Click on the tab labeled “**San Bernardino (SC),**” and record the total population. The total population is 934,733.
 - 12) Click “**Done.**” The user should now be at the Pop / Accrual screen. At this screen click on “**Next**” to proceed to the next screen.
 - 13) The user should now be at the “VMT/Trips” screen.
 - 14) Click on “**VMT.**”
 - 15) A dialog box will pop up titled “Editing VMT data for scenario 1: South Coast Air Basin Avg 2006 Summer Default Title.” This dialog box displays VMT by sub-area.
 - 16) Click on the tab labeled “**Riverside (SC)**” and record the total VMT. The total default VMT is 41,937,604. Click on the tab labeled “**San Bernardino (SC),**” and record the total VMT. The total default VMT is 32,225,784.
 - 17) Calculate the ratio of “New_VMT / Default_VMT” for both areas. This ratio for “**Riverside (SC)**” is $(50,000,000 / 41,937,604)$ **1.192247416**. The ratio for “**San Bernardino (SC)**” is **1.241242106**.

- 18) Multiply the default populations noted in step 11 with the ratios calculated in step 17. The new population for "Riverside (SC)" is **1,230,839** and **1,160,230** in "**San Bernardino (SC)**."
- 19) Click "**Done**" to exit the VMT editing screen.
- 20) Click "**Back**" to go back to *Pop / Accrual* editing screen.
- 21) Click on "**Population**" and then the tab for Riverside (SC).
- 22) Change the total population in Riverside (SC) to **1,230,839**. Click "**Apply**." Then click the tab for San Bernardino (SC). Change the total population to **1,160,230**. Again, click "**Apply**." Then click on "**Done**." This indicates end of population edits.
- 23) Click "**Next**" and proceed to *VMT / Trips* screen.
- 24) Click "**VMT**." Then verify that the VMTs in Riverside and San Bernardino are 50,000,000 miles per day and 40,000,000 miles per day, respectively. Note, the actual VMTs will be slightly different (less than 8 miles) due to the precision of the ratios calculated in step 17.
- 25) Click "**Done**." Then click "**Finish**." The user should now be back at the "**MAIN**" screen.
- 26) Click "**Save As**" to save and name the input file to an appropriate folder (folder Ex12 in the examples.zip file). In this example, the input file was named "SCAB_Subarea_newvmt_2006."
- 27) The user should now **run** the model and examine the difference in emissions between this scenario and the one generated from step 2.

Changing Trips

13. This example looks at two methods for changing trip estimates. It is based on an area (Santa Barbara) which institutes a new Transportation Control Measure (TCM) that reduces trips in 2006 to 1.9 million trips per day. The planner is then asked to estimate the potential emission reductions from this new TCM. There are two potential methods for doing this analysis and both are examined in this example. The first example (Ex13a) looks at a conformity approach to modifying trips, while the second (Ex13b) looks at a simple modification to the total trip estimates. Following is a brief summary of these examples.
 - Do a base run for Santa Barbara for 2006
 - Ex13a) – conformity method. This requires changing the population in order to match the new trip estimates. The default number of trips in Santa Barbara is 2,054,538. The population needs to be changed by a factor ($1,900,000 / 2,054,538 = 0.924782116$). The new population is $305,188 * 0.924782116 = 282,232$. Note, in addition to changing trips this method also changes the VMT estimates. We can make the changes on a hourly basis but this also implies that the VMT distribution should also change by hour.

- Ex13b) – trip change only. This requires that only trips be changed to 1,900,000.

Ex13a)

- 1) Follow steps 1 to 11 as shown in example Ex1 with the following changes. Click “**Geographic Area**”, and under *area type* select “**County**.” Then from the drop down select “**Santa Barbara**.” Click “**OK**.” This base scenario should be run for 2006 calendar year. Finally in the *Modes and Output* screen only select the **Text File (CSV)** format to output. This base scenario, used for comparative purposes, is saved as “SB_default_2006” in this example.
- 2) Run EMFAC2002
- 3) Select “**File**” and click “**New**.”
- 4) Click “**Add New Scenario**.”
- 5) Click “**Geographic Area**”, and under *area type* select “**County**.” Then from the drop down select “**Santa Barbara**.” Click “**OK**.” The calendar year should be 2006. Select the season as “**Summer**.” Click “**Next**” and proceed to *Scenario2* screen. Click “**Next**.” At the *Modes and Output* screen only select the **Text File (CSV)** format to output and select output options used in step 1.
- 6) At the *Mode and Output* screen, click on “**Edit Program Constants**.” The user should now be at the *Tech I / M* screen. Click “**Next**” to proceed to the next screen.
- 7) At the *Pop / Accrual* screen click on “**Next**” to proceed to the *VMT/Trip* screen.
- 8) At the *VMT / Trip* screen click on “**Trips**” and record the total number of trips in Santa Barbara county. The total number of default trips per day is 2,054,538. Calculate the ratio of new trips (from TCM) versus default trips in Santa Barbara in 2006. This ratio is **0.924782116**.
- 9) Calculate the new population in Santa Barbara ($305188 * 0.924782116 = 282,232$). Click “**Done**.” Click “**Back**” at the *VMT / Trips* screen and go back to the *Pop / Accrual* screen.
- 10) At the *Pop/Accrual* screen click on “**Population**.”
- 11) Change the total population Santa Barbara county to 282,232. Click “**Apply**.” Then click “**Done**.”
- 12) At the *Pop/Accrual* screen click on “**Next**,” and proceed to the “**VMT/Trips**” screen.
- 13) At the *VMT/Trips* screen click on “**Trips**” and verify that the change in population also changed the total number of trips per day to 1.9 million.
- 14) Click “**Done**,” and then click “**Finish**.” The user should now be back at the “**MAIN**” screen.
- 15) Click “**Save As**” and save and name the input file to an appropriate folder (folder Ex13 in the examples.zip file). In this example, the input file was named “SB_Conformity_trip_2006.”
- 16) Click “**Run**” to run the model.

Ex13b)

- 1) Run EMFAC2002
- 2) Follow steps 2 to 7 as shown in example 13a.
- 3) At the *VMT / Trip* screen click on **"Trips."** Change the total number of trips in Santa Barbara to county to 282,232. Click **"Apply."** Then click **"Done."**
- 4) Click **"Finish."** The user should now be back at the **"MAIN"** screen.
- 5) Click **"Save As"** and save and name the input file to an appropriate folder (folder Ex13 in the examples.zip file). In this example, the input file was named "SB_trip_changeonly_2006."
- 6) Run the model.

The user should compare emission outputs from both examples to determine which processes are affected by changes in the total number of trips per day. Hint: the exhaust emissions are also affected in the SIP_Conformity_trip_2006 run. Why?

Speed Distributions

14. Ex14a)

An area has developed a TCM, which requires trucks to only travel between midnight (0-Hr) and 8 am (7-Hr) and from 6 pm to midnight. Further, 5% of the VMT occurs at 5 mph, 25% occurs at 45 mph, 20% at 50 mph, and 50% at 65 mph. What are the emissions from this change? Following is a brief summary of the steps used in this example.

- Do a SCAB simple average run for 2005 calendar year.
- Do another run with the same basic scenario data and then press "Edit Fundamental Data." Proceed to the "Profiles / Speed" dialog and then depress "Speed Fraction."
- Set the Hour counter to "0" and select the light-heavy duty vehicle class. Then change the VMT speed distribution. Then apply this change to this hour and vehicle class. Then apply this change to other hours and vehicle classes.
- For vehicle classes select the light-heavy to heavy-heavy duty trucks.
- Then select hours 0-7 and 18-23.
- The go back and set the speeds to zero in the remaining hours for the same vehicle class.
- Save the file and run.
- NOTE, there are big reductions in emissions. These are not real!
- Remember, EMFAC runs on a hourly basis. If the hourly speed distributions are changed then the VMT speed distributions should also

be changed. In this run the hourly VMT is being multiplied by zero speeds, which is incorrect.

- 1) Run EMFAC2002
- 2) Follow steps 1 to 11 as shown in example Ex1 with the following changes. This base scenario should be run for 2005 calendar year. In the *Modes and Output* screen only select the **Text File (CSV)** format to output. This base scenario, used for comparative purposes, should be saved as "SCAB_2005_base" in this example.
- 3) Run EMFAC2002
- 4) Select "**File**" and click "**New.**"
- 5) Click "**Add New Scenario.**"
- 6) Click "**Geographic Area**", and under *area type* select "**Air Basin.**" Then from the drop down list select "**South Coast.**" Finally set the method selection to "**Simple Average.**" Click "**OK.**" The calendar year should be 2006. Select the season as "**Summer.**" Click "**Next**" and proceed to *Scenario2* screen. Click "**Next.**" At the *Modes and Output* screen only select the **Text File (CSV)** format to output and select output options used in step 1.
- 7) At the *Mode and Output* screen, click on "**Edit Program Constants.**" The user should now be at the *Tech I / M* screen. Click "**Next**" to proceed to the next screen.
- 8) At the *Pop / Accrual* screen click on "**Next**" to proceed to the *VMT/Trip* screen
- 9) At the *VMT / Trip* screen click on "**Next**" to proceed to the *Profiles / Speed* screen.
- 10) At the *Profiles / Speed* screen click on "**Speed Fractions.**" A dialog box titled "Speed Fractions by Scenario Year, Hour, and Vehicle Class" will pop up. This dialog box shows the percent of VMT by passenger cars in each speed bin for hour 8.
- 11) From the drop list for *vehicle class* select "**02: Light Heavy Duty Trucks. (T5)**" Set the *hour* index to "**0.**" Note hour **0** refers to midnight to 12.59 am. Hour **1** refers to 1 to 1:59 am, and so on.
- 12) For hour "**0**" change the speed distribution such that 5% of the VMT occurs at 5 mph, 25% occurs at 45 mph, 20% at 50 mph, and 50% at 65 mph. In the 5 mph bin change the value from 0.011% to 5.0%. In the 45 mph, 50 mph and 65 mph bins change the values from 1.4661%, 0.9612% and 69.6575% to 25.0%, 20% and 50%, respectively.
- 13) At this point, a note on the left-hand side of a yellow triangle will indicate to the user that total sums to "**127.9042%.**" The user should now put zeros in all other speed bins.
- 14) When the "**Totals**" equal 100%, the user should hit "**Apply**" to *Apply Changes to This Hour / Vehicle Class*. Once this done the other buttons on this screen become active.

- 15) Click "**Apply to Others**" to Apply This *Profile to Other Hours and Vehicle Classes*.
- 16) Another dialog box will pop up titled "Apply to Range?" This allows users to apply to other vehicle classes and hours. Click "**OK**."
- 17) Another dialog box titled "Apply Range Updates" pops up. Select vehicle classes "**Light HD Trucks (T5), Medium HD Trucks (T6), and Heavy HD Trucks (T7)**" and then press on the right arrows ">>."
- 18) The *Apply to* box should list four vehicle classes. Click "**OK**."
- 19) Another dialog box titled "Apply Range Updates" pops up. Select hours "**0100 to 0700**" and hours "**1800 to 2300**." Then click on the right arrows ">>." Click "**OK**."
- 20) The user should now be back at the speed fractions dialog screen. The user should now zero out the speeds for remaining hours. With the vehicle class selection still on "**02: Light HD Trucks (T4)**," change the hour counter to "**8**."
- 21) Change all the VMT percentages to "**0**." Then click on "**Apply**" to *Apply Changes to This Hour / Vehicle Class*.
- 22) Click "**Apply to Others**" to Apply This *Profile to Other Hours and Vehicle Classes*.
- 23) Another dialog box will pop up titled "Apply to Range?" This allows users to apply change to other vehicle classes and hours. Click "**OK**."
- 24) Another dialog box titled "Apply Range Updates" pops up. Select vehicle classes "**Light HD Trucks (T5), Medium HD Trucks (T6), and Heavy HD Trucks (T7)**" and then press on the right arrows ">>."
- 25) The *Apply to* box should list four vehicle classes. Click "**OK**."
- 26) Another dialog box titled "Apply Range Updates" pops up. Select hours "**0800 to 1700**." Then click on the right arrows ">>." Click "**OK**."
- 27) At the speed fractions dialog screen, click "**Done**."
- 28) The user should be at the *Profiles / Speed* screen. Click on "**Finish**."
- 29) At the "**MAIN**" screen click on "**Save As**," and save and name the input file to an appropriate folder (folder Ex14a in the examples.zip file). In this example, the input file was named "SCAB_2005_HDV_speed."
- 30) Run the model and compare the outputs with the default run.
- 31) Note the emission reductions are large, but are they correct?

14b)

A frequently asked question is what is the impact on IDLE emissions if heavy-heavy duty trucks (HHDT) idle for a given number of minutes. In this example the user is asked to calculate the change in idle emissions from heavy-heavy duty diesel trucks (HHDTs) if the idle time is doubled to 202.44 minutes per day. Following is a brief summary of the steps used in this example.

- Do a SCAB simple average run for 2005 calendar year.

- Do another run with the same basic scenario data and then press “Edit Fundamental Data.” Proceed to the “Profiles / Speed” dialog and then depress “Idle Time.”
 - Note, Idle time also has an hourly distribution. Click on the time and edit the time for vehicle class 8.
 - Save and run in Burden Mode.
- 1) Follow steps 1 to 11 as shown in example Ex1 with the following changes. This base scenario should be run for 2005 calendar year. In the *Modes and Output* screen only select the **Text File (CSV)** format to output. This base scenario, used for comparative purposes, should be saved as “SCAB_2005_base” in this example.
 - 2) Follow steps 2 to 8 as shown in example Ex14a.
 - 3) At the *Profiles / Speed* screen click on “**Idle Time.**” A dialog screen titled “Editing Idle Time For Scenario 1” will pop-up. This screen shows the total heavy-duty idle times, by vehicle class, for heavy-duty vehicles operating in the (in this example) South Coast air basin.
 - 4) The default idling time for “Heavy HD Trucks (T7)” is 101.2202 minutes per day per vehicle. Double-click this cell and change the time to “**202.44**” minutes. Click “**Apply.**” Then click “**Done.**”
 - 5) The user should now be back at the *Profiles / Speeds* screen. Click “**Finish.**”
 - 6) At the “**MAIN**” screen click on “**Save As,**” and save and name the input file to an appropriate folder (folder Ex14b in the examples.zip file). In this example, the input file was named “SCAB_HDV_Idletime_2005.”
 - 7) Run the model and compare the outputs with the default run.

14c)

Another frequently asked question is what is the idle emission rate (grams per hour)? The basic steps for generating this rate are: run the model in Emfac mode, select the appropriate temperature, relative humidity and set the speed to zero mph. Example 6 shows how to run the model in Emfac mode. In this example, the Idle emission rate is calculated for the SCAB region and for the 2005 calendar year. The rate is calculated at a temperature of 75°F and at a 40% relative humidity. The input file is saved as “SCAB_Idlerate_2005_Emfac.”

Phase-In Schedules

15. This example shows how the user can change the default phase-in schedules. This type of analyses is frequently done by ARB regulatory staff who have to assess the effect on emissions from regulatory changes that affect sales of future technology vehicles. This example assumes that the

state decides to revise the phase-in schedule of low emitting vehicles with the schedule shown below. The staff person is asked to determine the resulting change in emissions from this change. Following is a brief summary of the steps used in this example.

Phase-In Schedule for PC and LDTs			
Model Year	ZEVs	PZEV	ATPZEV
2005	5.0%	50.0%	45.0%
2006+	10.0%	30.0%	60.0%

- Do a Statewide simple average run for 2010 calendar year.
 - Do another run with the same basic scenario data and then press “Edit Fundamental Data.” Proceed to the “Tech / IM” dialog and then depress “Exh Tech Fractions.”
 - Look at the technology group table (Appendix 1 of the User’s Guide).
 - Index back to the 2005 model year and change the technology group fractions as indicated.
 - Apply changes to PC and T1, and to 2005 model year only.
 - Then change the schedule for 2006 model year. Apply the change to PC and T1, and 2007-2010 model years.
 - NOTE, THE CANCEL BUTTON DOES NOT WORK. This will be revised in the next model.
 - Then do the same changes to the evaporative technology fractions. In this case the ZEV group is 16 and assumes PZEV and ATPZEV fractions apply to 17.
- 1) Follow steps 1 to 11 as shown in example Ex1 with the following changes. The geographic area selection should be the entire **State**. The method selection should be “**Simple Average**.” This base scenario should be run for 2010 calendar year. In the *Modes and Output* screen only select the **Text File (CSV)** format to output. This base scenario, used for comparative purposes, should be saved as “State_Base_2010” in this example.
 - 2) Run EMFAC2002.
 - 3) Select “**File**” and click “**New**.”
 - 4) Click “**Add New Scenario**.”
 - 5) Click “**Geographic Area**”, and under *area type* select “**State**.” Set the method selection to “**Simple Average**.” Click “**OK**.” The calendar year should be 2010. Select the season as “**Summer**.” Click “**Next**” and proceed to *Scenario2* screen. Click “**Next**.” At the *Modes and Output* screen only select the **Text File (CSV)** format to output and select output options used in step 1.
 - 6) At the *Mode and Output* screen, click on “**Edit Program Constants**.” The user should now be at the *Tech I / M* screen. This screen allows editing by technology group, model year and vehicle class.

- 7) At the *Tech I / M* screen click on “**Exh Tech Fractions.**” A dialog screen labeled “Exhaust Tech Fractions by Model Year and Technology Group” pops up.
- 8) Change the *Model Year* counter to 2005. Note how the Exhaust technology fractions vary by model year, and by vehicle class. This screen shows that the 2005 model year consists of 6 technologies. For example 0.4% of 2005 model year sales consist of technology group 25 vehicles (ZEVs). For this example users should review Appendix 1 of the EMFAC2001/2002 user’s guide.
- 9) Change technology group indices 23, 24 and 28 percentages to “**0.**” Then change technology group indices 25, 31 and 37 to “**5%, 50% and 45%,**” respectively. These technology groups correspond to ZEV, PZEV and ATZEV, respectively.
- 10) Click “**Apply.**” Another dialog box will pop up titled “Apply to Range?” This allows users to apply changes to other vehicle classes and model years. Click “**OK.**” At the next dialog titled “Apply Range Updates” select “**Light-Duty Trucks (T1).**” Click on the right arrows “**>>.**” The *Apply To* area should have two vehicle classes listed.
- 11) Click “**OK.**” At the “Apply Range Updates” dialog screen click “**OK.**” The user has just applied technology fraction changes for 2005 model year. The next step is to apply changes to 2006 and newer model years.
- 12) Step up the index to the 2006 model year. This model year has 5 technology groups.
- 13) Change technology group indices 28, and 29 percentages to “**0.**” Then change technology group indices 25, 31 and 37 to “**10%, 30% and 60%,**” respectively. These technology groups correspond to ZEV, PZEV and ATPZEV, respectively.
- 14) Click “**Apply.**” Another dialog box will pop up titled “Apply to Range?” This allows users to apply this change to other vehicle classes and model years. Click “**OK.**” At the next dialog titled “Apply Range Updates” select “**Light-Duty Trucks (T1).**” Click on the right arrows “**>>.**” The *Apply To* area should have two vehicle classes listed.
- 15) Click “**OK.**” At the “Apply Range Updates” dialog screen select model years 2007, 2008, 2009 and 2010. Click on the right arrows “**>>.**” The user has just applied technology fraction changes to 2006 and newer model years.
- 16) At the dialog box labeled “Exhaust Tech Fractions by Model Year and Technology Group” click on “**Done.**”
- 17) At the *Tech I / M* dialog screen click on “**Evap Technology Fractions.**”
- 18) The user should now **also apply** similar changes to the evaporative technology fractions. Appendix 2 of the User’s Guide lists the evaporative technology fractions. For evaporative technology fractions, the ZEV group is 16, and the user can assume that the PZEV and ATPZEV fractions apply to technology group 17. Once these changes are done, click “**Finish**” at the *Tech I / M* screen.

- 19) At the “**MAIN**” screen click on “**Save As**,” and save and name the input file to an appropriate folder (folder Ex15 in the examples.zip file). In this example, the input file was named “State_Zev_Fraction_2010.”
- 20) Run the model and compare the outputs with the default statewide run.

Lifetime Emissions

16. ARB staff frequently asks the question “what are the lifetime emissions from technology group X?” In this example, the user is asked to calculate the **lifetime EXHAUST** emissions from an Ultra Low Emission Vehicle (ULEV). The analysts’ first question should be “what is the definition of lifetime?” In some cases it might be the age at which 50 percent of the vehicles have been scrapped. In this case the survival rate curve is examined (by those intimately familiar with EMFAC) to determine the age at which only 50% of the vehicles remain. In other cases, useful life is defined by the length of applicable certification standards. In this example, it is assumed that the useful life of a ULEV vehicle is 10 years. ULEVs were first introduced into California in 1997. In this lifetime calculation, the user has to determine the emissions on a per vehicle basis at all ages from age 1 to age 10. Following is a brief summary of the steps used in this example.

- Do a Statewide simple average run for 1997 calendar year and also set the starting and ending model year to 1997.
- Then Proceed to the “Tech / IM” dialog and then depress “Exh Tech Fractions.”
- Look at the technology group table (Appendix 1 in the EMFAC2001 / EMFAC2002 User’s Guide). ULEV is technology group 24.
- Change the technology group fraction to 100%.
- File Save and run scenario.
- Repeat the process for 1998 calendar year, but this time keep the starting and ending model year the same (1997). Remember, we are tracking how the emissions from this vehicle increases on a per vehicle basis.
- Then calculate the emissions from ULEV on a per vehicle basis at each age. The daily emissions are then multiplied by 365 days to get them on a per year basis. The sum then represents the lifetime calculation. Note, this is simplified in that it does not account for deterioration within the year since EMFAC calculates emissions at the end of the year.

- 1) Run EMFAC2002
- 2) Select “**File**” and click “**New**.”
- 3) Click “**Add New Scenario**.”

- 4) Click "**Geographic Area**", and under *area type* select "**State**." Set the method selection to "**Simple Average**." Click "**OK**." The calendar year should be 1997. Select the season as "**Summer**." Click "**Next**" and proceed to *Scenario2* screen.
- 5) At *Scenario2* screen the *Starting Model Year* should be set to "**1997**" and the *Final Model Year* should be set to "**1997**."
- 6) Click "**Next**." At the *Modes and Output* screen only select the **Text File (CSV)** format to output and select output options used in example Ex1.
- 7) At the *Mode and Output* screen, click on "**Edit Program Constants**." The user should now be at the *Tech I / M* screen. This screen allows editing by technology group, model year and vehicle class.
- 8) At the *Tech I / M* screen click on "**Exh Tech Fractions**." A dialog screen labeled "Exhaust Tech Fractions by Model Year and Technology Group" pops up.
- 9) Change the percentage for technology group indices 19, 20, 23 and 177 to "**0**" for passenger cars. Change the technology group 24 percentage to 100%.
- 10) Click "**Apply**." Another dialog box will pop up titled "Apply to Range?" This allows users to apply this change to other vehicle classes and model years. Click "**OK**."
- 11) At the dialog box labeled "*Apply Range Update*" click on "**OK**."
- 12) At the next dialog box labeled "Apply Range Updates" for Model Years click on "**OK**."
- 13) Click "**Done**" at the dialog screen titled "Exhaust Technology Fractions by Model Year..."
- 14) Click "**Finish**" at the *Tech I / M* screen.
- 15) At the "**MAIN**" screen click on "**Save As**," and save and name the input file to an appropriate folder (folder Ex16 in the examples.zip file). In this example, the input file was named "State_ULEV_Lifetime_1997CY."
- 16) Run the model.
- 17) Repeat steps 1 through 16 but change the calendar year to 1998, and save the input file as "State_ULEV_Lifetime_1998CY."
- 18) Repeat steps 1 through 16 but change the calendar year to 1999, and save the input file as "State_ULEV_Lifetime_1999CY."
- 19) Repeat steps 1 through 16 but change the calendar year to 2000, and save the input file as "State_ULEV_Lifetime_2000CY."
- 20) Repeat steps 1 through 16 but change the calendar year to 2001, and save the input file as "State_ULEV_Lifetime_2001CY."
- 21) Repeat steps 1 through 16 but change the calendar year to 2002, and save the input file as "State_ULEV_Lifetime_2002CY."
- 22) Repeat steps 1 through 16 but change the calendar year to 2003, and save the input file as "State_ULEV_Lifetime_2003CY."
- 23) Repeat steps 1 through 16 but change the calendar year to 2004, and save the input file as "State_ULEV_Lifetime_2004CY."

- 24) Repeat steps 1 through 16 but change the calendar year to 2005, and save the input file as "State_ULEV_Lifetime_2005CY.
 - 25) Repeat steps 1 through 16 but change the calendar year to 2006, and save the input file as "State_ULEV_Lifetime_2006CY.
 - 26) Repeat steps 1 through 16 but change the calendar year to 2007, and save the input file as "State_ULEV_Lifetime_2007CY.
 - 27) The user should then calculate the grams per vehicle per day running exhaust emissions from passenger cars for all the calendar years. This calculation, shown in the MS-Excel sheet labeled "Lifetime_Emissions_ULEV.xls," produces the average grams/vehicle/day running exhaust emissions by age. This average daily rate is then multiplied by 365 days to get yearly emissions, which are then summed to yield the lifetime emissions.
17. There are several ways of reducing emissions from in-use vehicles (Inspection and Maintenance programs, vehicle scrappage, and vehicle retrofit). This example investigates the potential benefits in 2010 calendar year if pre-1998 model year heavy-heavy duty diesel trucks are equipped with particulate traps. Further, it is assumed that the efficiency of traps varies by model year. The traps reduce particulate emissions by 40% for pre-1990 model year trucks, and by 30% for 1990 to 1997 model year trucks. Following is a brief summary of the steps used in this example.
- Do a Statewide simple average run for 2010 calendar year.
 - Then set up a multiple scenario run for model years 1965 to 2010, in calendar year 2010.
 - Then apply percentage reductions by model year, and aggregate.
- 1) Run EMFAC2002
 - 2) Select "**File**" and click "**New**."
 - 3) Click "**Add New Scenario**."
 - 4) Click "**Geographic Area**", and under *area type* select "**State**." Set the method selection to "**Simple Average**." Click "**OK**." The calendar year should be 2010. Select the season as "**Summer**." Click "**Next**" and proceed to *Scenario2* screen.
 - 5) At *Scenario2* screen the *Final Model Year* should be set to "**1965**" and the *Starting Model Year* should be set to "**1965**." In addition the scenario title should be changed to "Statewide totals Avg 2010 Summer 1965 MY."
 - 6) Click "**Next**." At the *Modes and Output* screen only select the **Text File (CSV)** format to output and select other options as noted in example Ex1.
 - 7) Click "**Finish**" at the *Modes and Output* screen.
 - 8) At the "**MAIN**" screen click on "**Add New Scenario**."
 - 9) A dialog box, titled "Editing Scenario Data," will pop up. Click "**OK**."

- 10) Click "**Next**" at the *Scenario1* screen.
- 11) At *Scenario2* screen the *Final Model Year* should be set to "**1966**" and the *Starting Model Year* should be set to "**1966**." The scenario title should be changed to "Statewide totals Avg 2010 Summer 1966 MY."
- 12) Click "Next." At the *Modes and Output* screen click "**Finish**."
- 13) Repeat steps 8 to 12, but change model year to 1967.
- 14) Repeat steps 8 to 12, but change model year to 1968.
- 15) Repeat steps 8 to 12, but change model year to 1969.
- 16) ...
- 17) ...
- 18) Repeat steps 8 to 12, but change model year to 2009.
- 19) Repeat steps 8 to 12, but change model year to 2010.
- 20) At the "**MAIN**" screen the area listing available scenarios should show 46 scenarios (corresponding to a run for each model year) in this run.
- 21) At the "**MAIN**" screen click on "**Save As**," and save and name the input file to an appropriate folder (folder Ex17 in the examples.zip file). In this example, the input file was named "State_Retrofit_2010."
- 22) Run the model.
- 23) The user should then ascertain the tons per day total exhaust particulate emissions from heavy-heavy duty diesel trucks for each model year. This step is shown in MS-Excel spreadsheet labeled "Retrofit_Sample_Calc.xls." The model year specific emissions are then multiplied by reductions associated with equipping some trucks with particulate traps. The difference in emissions, with and without particulate traps, is then used to calculate the benefits of a retrofit program.

Appendix 1

Table 1

Emfac mode - ASCII Impacts File Format

Header	Notes
Line 1-1	Scenario title
Line 1-2	EMFAC99 Version Number
Line 2	Senario Calendar Year; Number of Micro speeds, Number of Micro Temperatures, Number of Micro Rel. Humidities, Date
Line 3-1	Micro Speeds
Line 4-1	Temperature
Line 5-1	Relative Humidity
Line 6-A	Vehicle Class, Veh-tech, Vehicle Label, Technology Label-NCAT, Fraction(VMT,NCAT), Fraction(Start,Ncat), Fraction(Pop, Ncat), Cum_odometer. (Cum_odometer = VMT * 365 / Population)
Line 6-B	Vehicle Class, Veh-tech, Vehicle Label, Technology Label-CAT, Fraction(VMT,CAT), Fraction(Start,CAT), Fraction(Pop, CAT), Cum_odometer. (Cum_odometer = VMT * 365 / Population)
Line 6-C	Vehicle Class, Veh-tech, Vehicle Label, Technology Label-DSL, Fraction(VMT,DSL), Fraction(Start,DSL), Fraction(Pop,DSL), Cum_odometer. (Cum_odometer = VMT * 365 / Population)
Line-7	
Line-8	Emissions Process, Vehicle class, Veh-tech, IM, Season, Humidity, Temp, Speed, (THC,TOG, ROG), CO, NOx, (PM-exhaust (Total/PM10/PM2.5)), PM-Tire wear, PM-Break wear, Fuel (zero), Evaporative, Time (mins)

	Code	Description
Emissions Process	B	Crankcase emissions
	L	Diurnal losses
	K	Hot soak losses
	G	Resting losses
	S	Start emissions
	R	Running emissions
Vehicle Class	1	PASSENGER CARS
	2	LIGHT-DUTY TRUCKS
	3	LIGHT-DUTY TRUCKS
	4	MEDIUM-DUTY TRUCKS
	5	LIGHT-HEAVY DUTY TRUCKS
	6	LIGHT-HEAVY DUTY TRUCKS
	7	MEDIUM-HEAVY DUTY TRUCKS
	8	HEAVY-HEAVY DUTY TRUCKS
	9	LINE-HAUL VEHICLES
	10	URBAN BUSES
	11	MOTORCYCLES
	12	SCHOOL BUSES
	13	MOTOR HOMES
Veh-Tech	1	Non-catalyst-gasoline fueled
	2	Catalyst-gasoline fueled
	3	Diesel fueled
IM	Y	Yes
	N	No
Season	S	Summer
	W	Winter
	J	January
	F	February
	M	March
	A	April
	M	May
	J	June
	J	July
	A	August
	S	September
	O	October
	N	November
	D	December
	A	Annual Average
Humidity	%	Relative humidity (%)
Temperature	oF	Temperature (oF)
Speed	mph	Speed (mph)

Table 2**Emfac mode ASCII Impacts - Units**

Emissions Process	THC / ROG / TOG	CO	NOx	PMEX	PMTW	PMBW	FUEL	EVAP	time
R	g/hr	g/hr	g/hr	g/hr	g/hr	g/hr	gallons/hr	RLS-g/hr	0
L	MDDI-g/hr	0	0	0	0	0	0	PDI-g/hr	0
G	MDRL-g/hr	0	0	0	0	0	0	PRL-g/hr	0
K	0	0	0	0	0	0	0	g/trip	0
S	g/start	g/start	g/start	g/start	0	0	gallons/start	0	minutes
B	0	0	0	0	0	0	0	0	0
Process	Notes								
R	During vehicle operation, exhaust emissions are noted under the columns titled THC / CO / NOx / PMEX / PMBW, and evaporative emissions (running loss) are noted under the EVAP column.								
L	Diurnal emissions from vehicles that are inoperative for multiple days are noted under the THC column, while partial day diurnals are noted under the EVAP column								
G	Resting loss emissions from vehicles that are inoperative for multiple days are noted under the THC column, while partial day resting loss emissions are noted under the EVAP column								
S	Starting emissions are noted under the columns titled THC / CO / NOx / PMEX columns while the soak time in minutes is noted under the column titled time.								
PMEX	Particulate emissions from vehicle exhaust								
PMBW	Particulate emissions from brake wear								
PMTW	Particulate emissions from tire wear								

Table 3**Calimfac mode****CYW File**

For reports with this title: CALENDAR YEAR EMISSION FACTORS W/O I/M

Or this title: CALENDAR YEAR EMISSIONS FACTORS WITH I/M

SEE (scenario).OUT FOR I/M OPTIONS USED

Heading	Units	Use with Activity:	Notes
Identifying items			
VEH	Vehicle type		Vehicle class 1 to 13
CYR	Calendar year		Calendar year range is always 1980 through scenario calendar year
Emission factors			
-TOG -	g/mi	VMT	HC type varies with output option
--CO--	g/mi	VMT	
--NOx-	g/mi	VMT	
-HtSk-	g/trip	Trips (Starts)	Evap hot-soak losses
-RunL-	g/trip	Trips (Starts)	Evap running losses
-Rest-	g/hr	Population	Evap resting losses
-Drnl-	g/hr	Population	Evap diurnal losses
-PM10-	g/mi	VMT	PM includes exhaust + brake wear + tire wear
Emission factors are weighted average for the ages and technologies in the scenario fleet in the calendar year. Average includes gasoline and diesel vehicles.			

Table 4**Calimfac mode****MY1 and MY2 Files**

For reports with this title (MY1 file): I/M Stat : No I and M program in effect

Or this title (MY2 file): I/M Stat : I and M program in effect

Heading	Units	Use with Activity:	Notes
Identifying items			
VEH	Vehicle type		Vehicle class 1 to 13
MYR	Model Year		Model years from 1965 to scenario calendar year
AGE	Vehicle age		
ODOM	miles	--	Odometer reading at the end of each year, by vehicle type and age.
TFRAC	fraction	--	VMT travel fraction for age AGE, from total VMT for VEH in one calendar year
Emission factors			
TOG	g/mi	VMT	
CO	g/mi	VMT	
NOX	g/mi	VMT	
PM10	g/mi	VMT	PM includes exhaust + brake wear + tire wear
HTSK	g/trip	Trips (Starts)	Evap hot-soak losses
RUNL	g/trip	Trips (Starts)	Evap running losses
PRL	g/hr	Population	Evap resting losses
MDRL	g/hr	Population	Evap resting losses
PDI	g/hr	Population	Evap diurnal losses
MDDI	g/hr	Population	Evap diurnal losses
Model year flex-point ages			
HFP	age, years		HC flex point
CFP	age, years		CO flex point
NFP	age, years		NOx flex point
PFP	age, years		PM flex point
EFP	age, years		Evap flex point
Emission factors are the weighted average for the technologies and fuels (gas and diesel) in the scenario fleet in the model year.			
Since odometer accrual does not vary by calendar year, the VMT travel fraction for a specific age is the same for all calendar years. The travel fraction may not add up to 1.0 unless all ages through 45 years are included. Flex point - Age at which the emissions deterioration rate changes.			